FURUNO®

DC-2000
Digital Compass

Installation Manual

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⚠ SAFETY INSTRUCTIONS

⚠ WARNING

Do not work inside the equipment unless totally familiar with electrical circuits.

Hazardous voltage which can shock, burn or cause serious injury exists inside the equipment.

Turn off the power at the mains switchboard before beginning the installation. Post a sign near the switch to indicate it should not be turned on while the equipment is being installed.

Fire, electrical shock or serious injury can result if the power is left on or is applied while the equipment is being installed.

⚠ CAUTION

Ground the equipment to prevent electrical shock and mutual interference.

Confirm that the power supply voltage is compatible with the voltage rating of the equipment.

Connection to the wrong power supply can cause fire or equipment damage. The voltage rating appears on the label at the rear of the display unit.

Use the correct fuse.

Use of a wrong fuse can cause fire or equipment damage.

1. CONNECTION OF EXTERNAL EQUIPMENT

Autopilot FAP-330, FAP-300

- The DC-2000 outputs magnetic heading data. Therefore the course set on the AUTO mode is magnetic heading.
- Compensate the DC-2000 for magnetic deviation before operating the FAP-330/300. Without compensation, the FAP-330/300 cannot control the boat correctly.
- Select small damping value. Too large damping causes the vessel (especially small boats) to meander after a turn. The default setting is "1."
- The sensor unit is powered via the terminal J3 on the processor unit of the autopilot.

For further information consult the operator's manual of the autopilot.

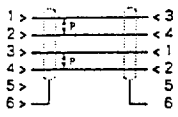
Current Indicator CI-60

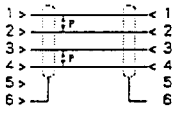
- The DC-2000 cannot be connected to the CI-60G; it is designed for connection with a gyrocompass.
- The DC-2000 outputs magnetic heading data. Therefore, the CI-60 shows magnetic heading regardless of its operating mode.
- Compensate for magnetic deviation, to ensure correct heading is output to the CI-60.

Radars

- Do not connect the DC-2000 to ARPA radars; they are designed for connection with gyrocompasses.
- Transmit heading data in 25ms interval, AD-10 format.
- Do not connect to a radar which has north-up and course-up orientation modes.

Signal Cable





- There are two kinds of signal cables; one is gray outer shieth and other one is black. Gray one is for interconnection between DC-2000 and C-2000. Black one is used for external equipment.

MJ-A6SPF0012-100: Outer shieth is gray. Cores are cross. (Interconnection between DC-2000 and C-2000)

Outer shieth is black. Cores are straight (Optional supply)

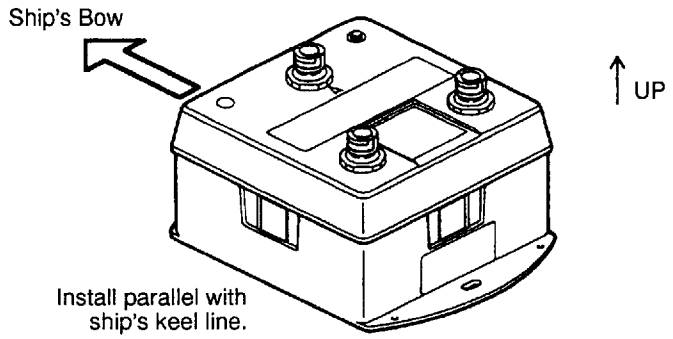
Mounting of Sensor Unit C-2000

Mounting considerations

The unit can be mounted on a tabletop or a bulkhead. Install the unit where the LED display can be easily viewed and serviced.

When selecting a mounting location, keep the following points in mind, in addition to those already mentioned.

- Align the arrow mark on the top side of the sensor unit parallel with ship's keel line.



- Data output cables and power cable do not have armor. If necessary run them through suitable conduit tubing.
- Face the connectors upward.
- Install the unit close as possible to ship's center of gravity.
- Install the sensor as far away as possible from the following:

Engine	Steel fuel tank
Steel water tank	Bilge pump
Anchor and anchor chain	Power cable
Steel mast	Steel mast support
Steel keel	Antenna cable for radio

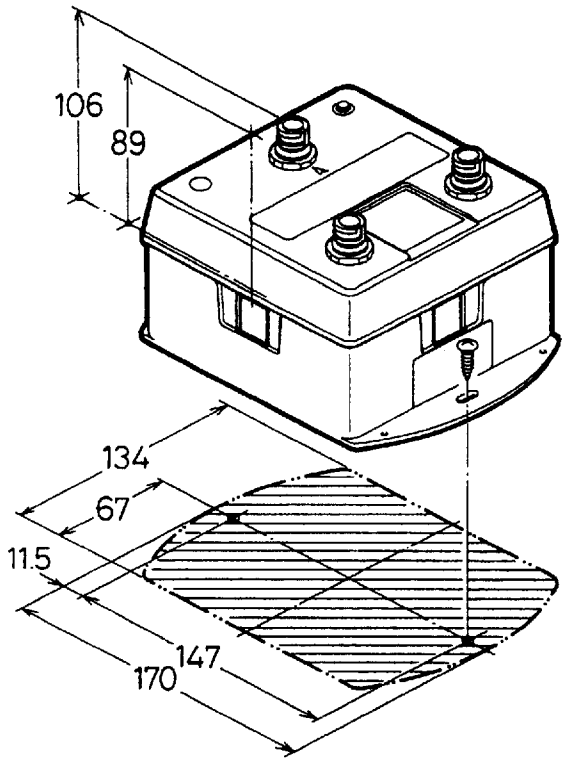
- Use the supplied power cable.
- Cover unused data output connectors with caps (supplied).
- The maximum magnetic deviation which can be compensated is 30°.

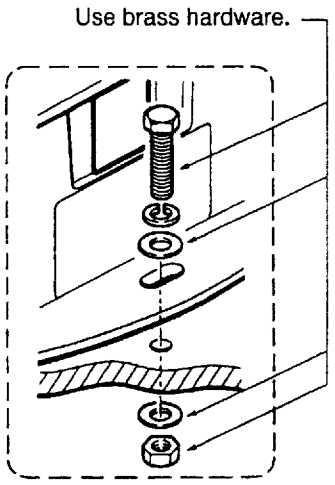
Mounting

The unit can be mounted on a tabletop or bulkhead.

Tabletop

Align the arrow mark on the top of the sensor unit with ship's keel line. Be sure the mounting location permits easy opening of the top lid and unobstructed access to connectors.





- All dimensions in millimeters.
- For added support, use nuts, bolts and washers instead of tapping screws.
- Leave sufficient space at sides and top of unit to permit servicing.

Fasten the unit to the mounting place with tapping screws (supplied). For added support, use M4 bolts, nuts and washers instead of tapping screws.

The unit is made of plastic; do not overtighten screws, to prevent damage to the unit.

Bulkhead mounting

Use the bulkhead mounting kit (OP64-9, Code No. 000-040-413).

Ground

Ground the C-2000 only when it causes interference to other equipment. For example, radiotelephone noise increases or video picture contains noise when the C-2000 is on. If the C-2000 causes interference to a magnetic compass, relocate the C-2000.

For the ground wire, use 1.25 sq wire which does not contain steel.

Mounting of Display Unit DD-2000

Mounting considerations

The display unit cannot be installed outdoors; water leakage will damage the sensitive components inside. The mounting location should be free of water splash and the temperature and humidity stable and moderate. When selecting a mounting location, keep in mind the following points.

- Locate the unit away from water splash.
- Keep the unit out of direct sunlight because of heat that can build up inside the cabinet.
- Leave sufficient space behind the unit to permit access to the connectors there.
- For tabletop installation, leave sufficient space on the sides of the unit to permit access to the knob bolts.
- Select a location where vibration is minimal.

Mounting

The display unit can be mounted on a tabletop or in a panel (flush mounting).

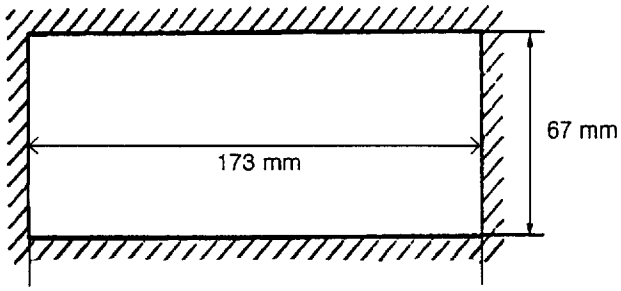
Tabletop

1) Using the hanger as template, mark location of screw holes in tabletop.
2) Fix the hanger to the mounting location with tapping screws (supplied).
3) Fit rubber cushions (supplied) between the hanger and the display unit. Set the display unit to the hanger and secure it with knob bolts.

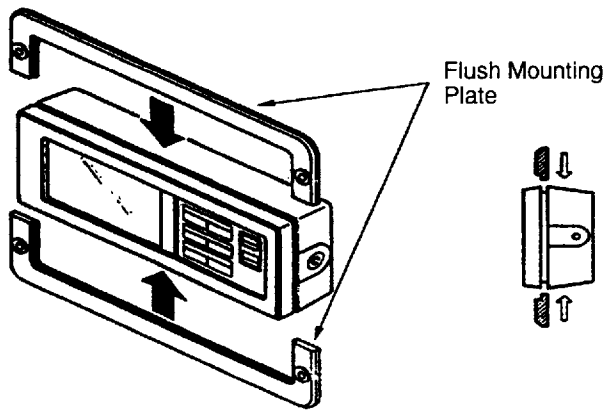
Flush mounting

This method requires the flush mounting kit supplied (see page D-2).

1) Prepare a cutout in the mounting location by the dimensions shown in the figure below.



2) Set the two flush mounting plates to the display unit.



3) Fasten the display unit to the mounting location with four tapping screws (local supply).

NOTE: *The DC-2000 may be installed together with the Temperature Indicator T-2000 by using flush mounting kit OP64-10 (Code No. 004-413-880).*

Mounting of Voltage Transformer

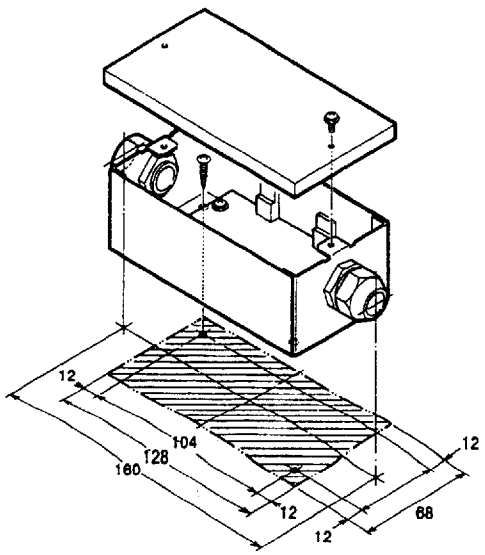
The voltage transformer is required for ship's mains of 16 VDC to 40 VDC and is connected to the sensor unit.

Mounting considerations

This unit is not waterproof. When selecting a mounting location, keep in mind the following points.

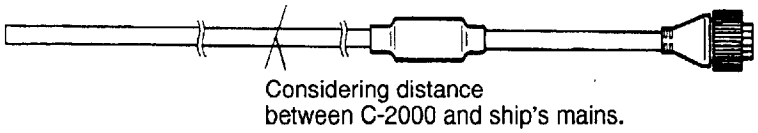
- Select a location free of water splash.
- Select a location in which temperature and humidity are moderate and stable.
- Keep the unit away from exhaust pipes.
- Locate the unit well away from air conditioners and heaters.
- Select a well ventilated location.
- Select a location which is low in vibration and shock.

Mounting dimensions



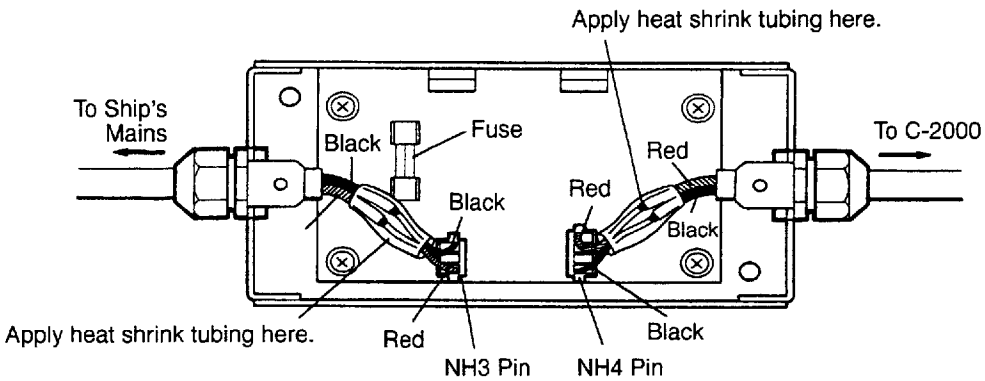
Wiring

1) The voltage transformer connects between the ship's mains and the C-2000. Shorten the power cable (supplied) considering the distance between the voltage transformer and ship's mains.



2) Pass cables into the voltage transformer.

3) Connect cables inside the voltage transformer as shown below.

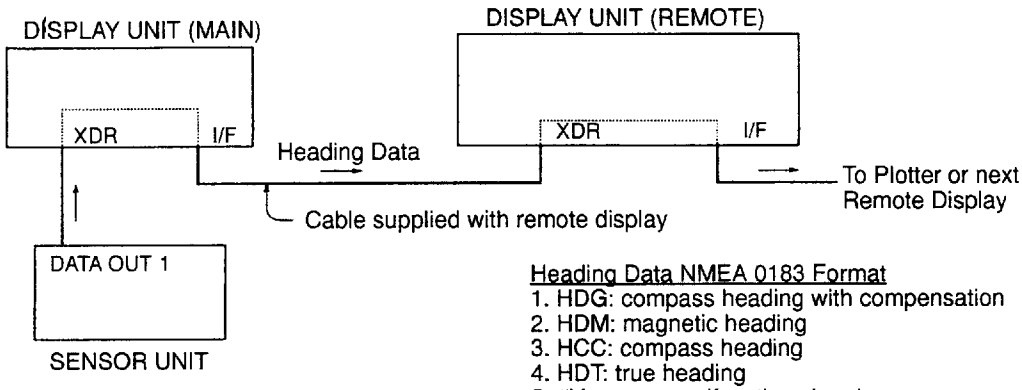


4) Apply heat shrink tubing (or tape) to cables as shown above.

Mounting of Remote Display DD-2000

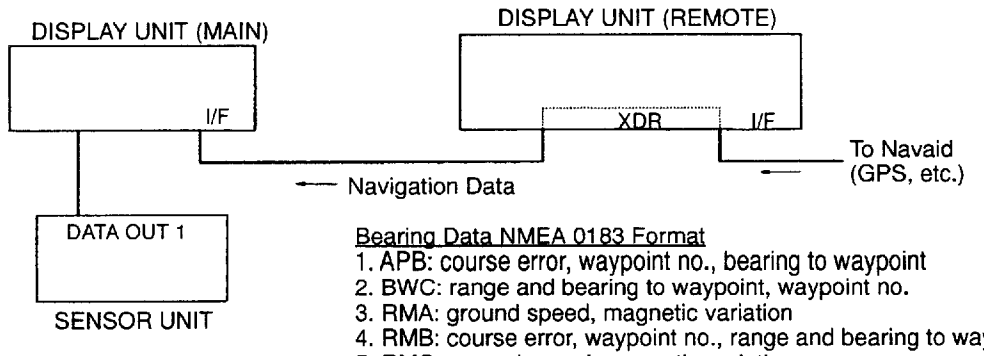
The remote display is identical to the main display. Connect it as follows.

Heading signal flow



Heading Data NMEA 0183 Format
1. HDG: compass heading with compensation
2. HDM: magnetic heading
3. HCC: compass heading
4. HDT: true heading
5. #Y: sensor malfunction signal

Navigation data flow



Bearing Data NMEA 0183 Format
1. APB: course error, waypoint no., bearing to waypoint
2. BWC: range and bearing to waypoint, waypoint no.
3. RMA: ground speed, magnetic variation
4. RMB: course error, waypoint no., range and bearing to waypoint
5. RMC: ground speed, magnetic variation
6. VTG: ground speed
7. XTE: cross track error

Setting C-2000's Output Data Format

Overview

The C-2000's data output format is set with jumper wires JP-1, JP-2, JP-3 and JP-4. In the tables which follow default output format setting is in boldface and upper case, and no jumper connection is shown in lower case.

JP-1

#1 #2 #3 #4

on ..... For NMEA 0183 output, set transmission interval to 200 ms.

OFF ..... For NMEA 0183 output, set transmission interval to 1 second.

ON ..... Not used.

on ..... Damping factor fast.

OFF ..... Damping factor slow.

ON .... Not used.

JP-3/JP-4 (DATA OUT 1)

When the C-2000 is connected to the DD-2000, the settings shown in the table below should be maintained. When the C-2000 is connected separately, set it according to specifications of equipment connected.

Jumper / Setting	JP-3					JP-4			
	#6	#7	#8	#9	#10	#1	#2	#3	#4
NMEA 0183	**ON**	**ON**				**ON**	**ON**		
AD-10 Format Tx interval 200 ms			on	on				on	on
AD-10 Format Tx interval 25 ms				on	on			on	on

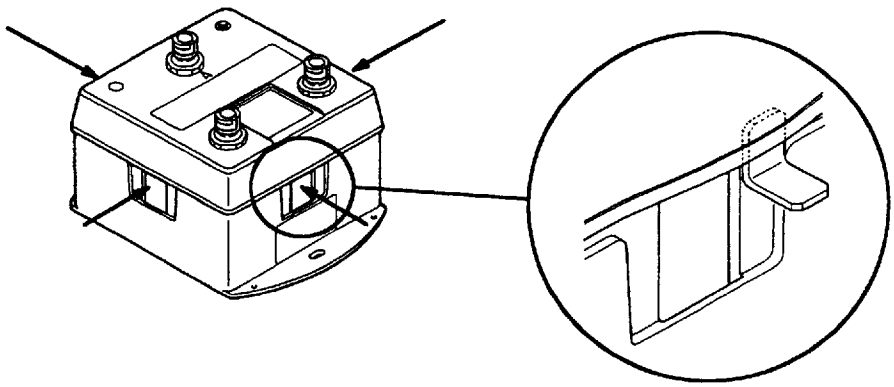
JP-2 (DATA OUT 2)

Setting \ Jumper	JP-2				
	#1	#2	#3	#4	#5
NMEA 0183 Output	on	on			
AD-10 Format, Tx interval 200 ms			**ON**	**ON**	
AD-10 Format, Tx interval 25 ms				on	on

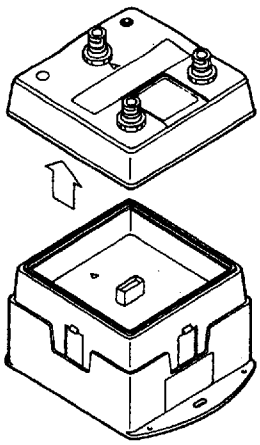
Procedure

Disassembly

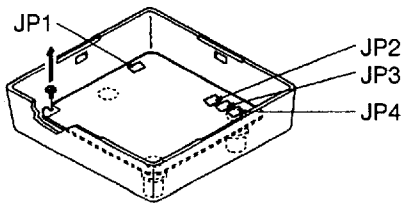
1) Insert the sensor unit lid openers (two supplied) into any two catches in the unit. Insert fingers in other catches.



2) Pull to remove the lid.

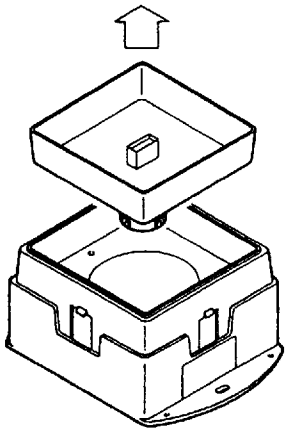


3) Turn the lid upside down.



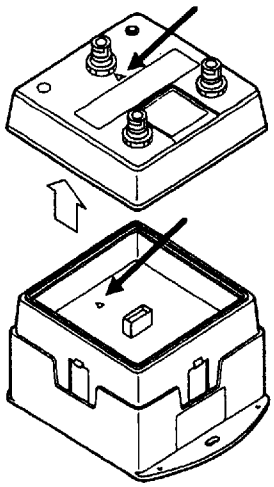
4) Change jumper block location as necessary.

NOTE: *To dismount the sensor unit fixing plate, lift it up by the projection in the center of the plate.*

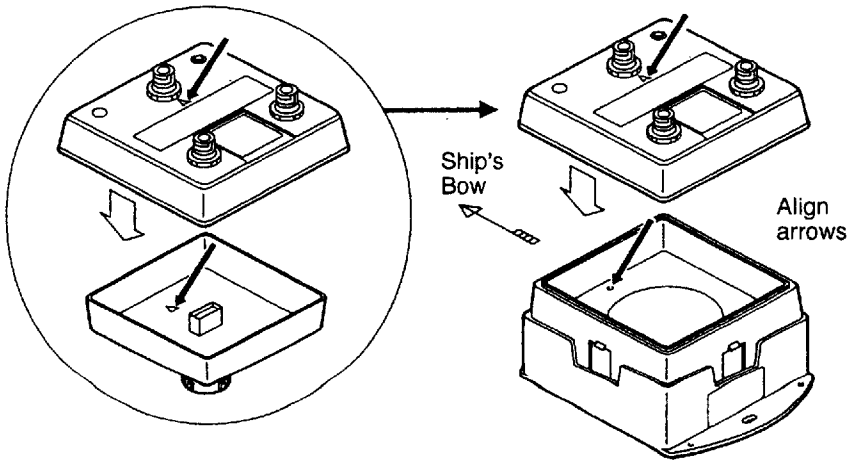


Assembly

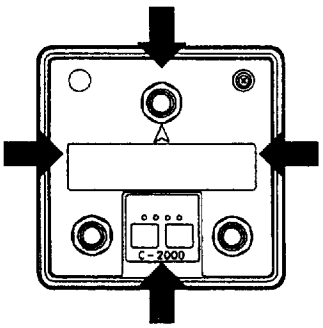
1) Set the lid to the chassis, aligning the arrow on the lid with the arrow on the chassis.



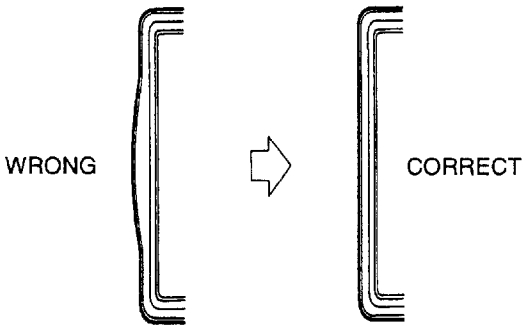
NOTE: *Reassemble the sensor unit fixing plate as shown below.*



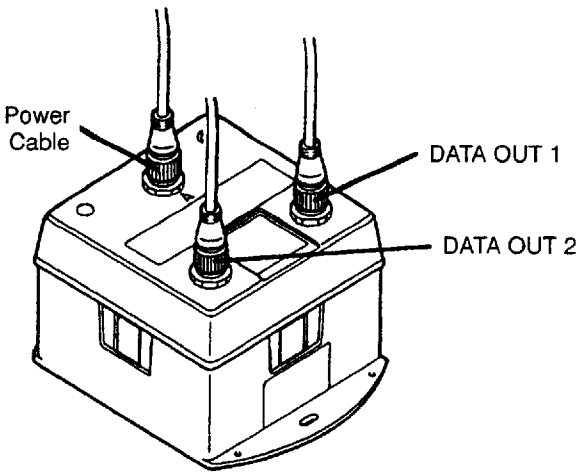
2) Push down on the lid. It should snap in place.



3) If the lid is not positioned correctly it will project beyond the chassis as shown in the figure below. Set the lid to the chassis again.



4) Reattach cables.



Turning on the Power

Display unit DD-2000

Press the [PWR/DIM] key to turn on the power. The LED test checks the unit for proper operation and then ship's heading appears.

If the sensor unit is not powered (by ship's mains or autopilot), there is trouble with the cable connected between the sensor and the display unit, or the sensor unit itself is malfunctioning, ship's heading does not appear and the buzzer sounds.

Sensor unit C-2000

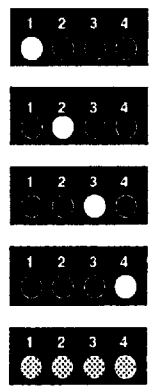
The C-2000 does not have a power switch nor is it electrically connected to the DD-2000. When the autopilot or ship's mains is turned on, the C-2000 is automatically checked for proper operation, showing the results by LED. At the end of the test, the #2 LED (green) blinks.

Self-test

① LED test

The #1 through #4 LEDs light one by one, and then they blink twice.

○ : Lighting
◎ : Blinking
● : OFF



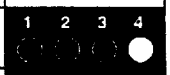
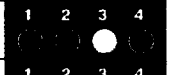
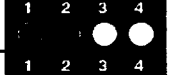
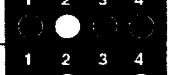
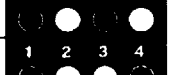
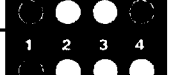
All LEDs blink twice

② C-2000 program version display

The last digit of the program version number is displayed by a lighting LED for five seconds as shown in the table below.

○ : Lighting
● : Blinking

225-0122-10□
└

Program Version No.	LED State
0	
1	
2	
3	
4	
5	
6	
7	

③ Memory test

For no error, the #2 LED continuously blinks every second.

Blinking
(normal state)

#1 LED lights for no error.

If the #1 LED blinks, suspects incorrect installation of the C-2000; for example, unit is too close to steel object.

Deviation Compensation

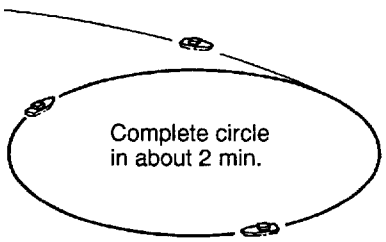
Overview

The sensor unit must be compensated for magnetic field deviation aboard the vessel. The procedure is simple: Turn the vessel in a complete circle at a fixed speed; the DC-2000 automatically calculates the amount of compensation required and outputs it to the sensor unit.

Procedure

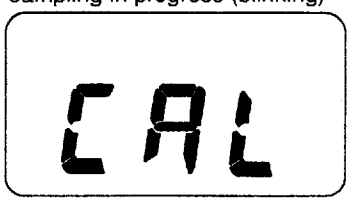
1) Find a calm and clear area without current, wind swell or waves.

2) Turn the boat clockwise or counterclockewise in a complete circle, taking about two minutes to complete the circle.



3) While turning the boat, press and hold down both [NAV] and [DAMP] until "CAL" appears and blinks on the display. This turns on the compensation circuit.

(a) Compensation mode, data sampling in progress (blinking)



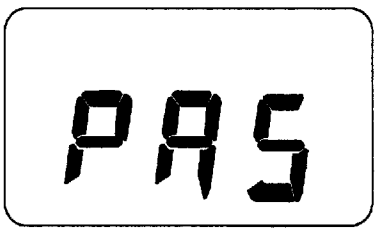
4) Turn the vessel an additional two to three turns until "CAL" lights up continuously.

(b) Compensation mode, data sampling finished (blinking)

If "CAL" does not light after turning the vessel four or more turns, press the [NAV] key to start data sampling and turn the vessel two to three turns.

If compensation was completed satisfactorily, "PAS" appears and blinks on the display.

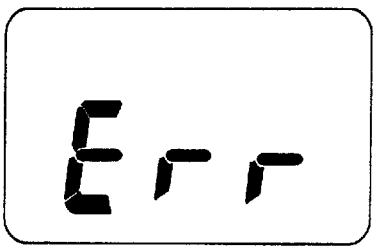
(c) Result of compensation (blinking when successful)



5) Press the [DAMP] key to restore normal operation. (You can also restore operation automatically by waiting 30 seconds.)

If "ERR" appears on the display, compensation failed. Press the [NAV] key to start again. Display (a) on the previous page appears. Turn the vessel two to three times to perform the compensation.

(d) Result of compensation (compensation failed; blinking)



Heading Alignment

Overview

Heading alignment is necessary when the heading output by the sensor unit does not match that of the ship's master compass.

First, measure the ship's heading as accurately as possible. Then, calculate the difference between it and the heading displayed on the DC-2000. This is the value you will enter into the DC-2000.

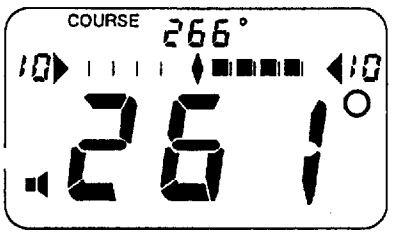
Procedure

Follow the procedure below to align heading.

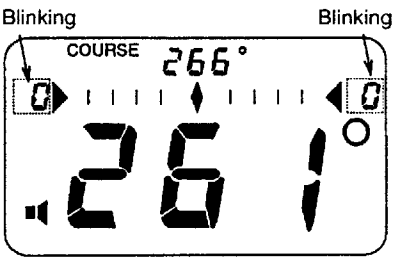
1) Press [+] and [–] of [RANGE SET] until a display similar to figure (B) appears. The default setting is zero degrees; zero degrees appears at both the left and right sides of the display. The compensation range is ±90°.
2) Press the [+] or [–] keys of [RANGE SET] to set compensation. Each press of those keys changes the compensation value by one degree.

NOTE: *The analog bar on the heading alignment display shows compensation direction; not the amount of compensation. All segments light according to compensation direction (negative or positive).*

(A) Normal Display (example)

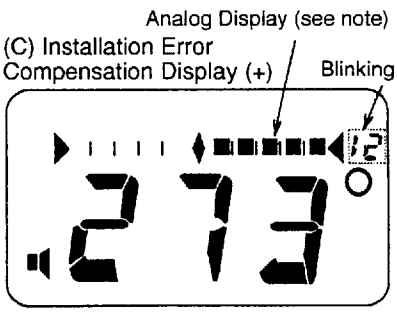


(B) Installation Error Compensation Display (default setting: 0)



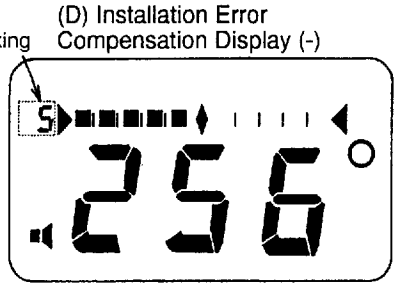
Analog Display (see note)

(C) Installation Error Compensation Display (+)



261° + 12° = 273°

(D) Installation Error Compensation Display (-)



261° - 5° = 256°

Damping Adjustment

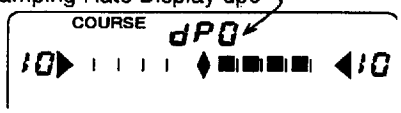
Overview

The damping factor determines how sensitively the sensor responds to change of ship's heading. The smaller the factor the quicker the response.

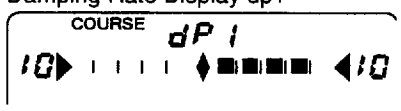
Procedure

1) With the unit in normal operating condition, press the [DAMP] key for more than two seconds. The current damping figure appears.
2) Press the [DAMP] key. Each pressing changes the damping factor in the sequence shown below.
3) About two seconds later the normal display appears and damping factor is updated.

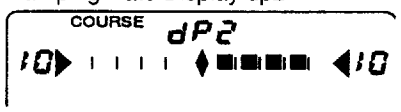
Damping Rate Display dp0



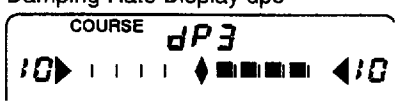
Damping Rate Display dp1



Damping Rate Display dp2



Damping Rate Display dp3



Setting dp0
reaction time: slow
Setting dp3
reaction time: fast

5. SPECIFICATIONS

General

Power	Sensor unit: 10 to 16 VDC Display unit: 10.8 to 35 VDC
Power Consumption	Sensor unit: max. 120 mA Display unit: max. 200 mA
Bearing Resolution	Display unit: 1° Sensor unit output signal: 0.1° (NMEA 0183 format) : 1 minute (AD-10 format)
Accuracy	±1° (with deviation compensation)
Damping Function	Four levels, settable
Deviation Compensation	Provided (can be done from sensor unit or display unit)

Environmental Conditions

Temperature	Sensor unit: accuracy guaranteed within range of 0 to +50°C; useable temperature -10 to +70°C Display unit: useable temperature range -10 to +50°C
Humidity	Sensor and display units: +40°C @ 95%
Waterproof test	Sensor and display units: IEC529 IPX6

Mass and Dimensions

Mass	Sensor unit: 450 g Display unit: 400 g
Dimensions	Sensor unit: 170 × 134 × 90 (mm) Display unit: 35 × 196 × 86 (mm)

6. EQUIPMENT LISTS

Complete Set

Name	Type	Code No.	Qty	Remarks
Sensor Unit	C-2000-E	000-040-402	1	
Display Unit	DD-2000-E	000-040-415	1	
Spare Parts	SP64-01100	000-040-416	1 set	
Installation Materials	CP64-01800	000-040-417	1 set	
Accessories	FP64-00900	000-040-418	1 set	

Spare Parts (SP64-01100)

Name	Type	Code No.	Qty	Remarks
Fuse	FGBO 0.5A 250VAC	000-549-018	2	

Accessories (FP64-00900)

Name	Type	Code No.	Qty	Remarks
Waterproofing Cap	22S0049-0	000-109-510	2	
Hanger	12-003-3301-0	100-156-220	1	
Hanger Cushion	12-003-3302-0	100-156-230	2	
Knob	12-003-3303-0	100-156-240	2	
Tapping Screw	6 x 20 SUS304	000-800-414	2	
Flush Mount Plate	22-003-2001-I	100-085-621	2	
Binding Tapping Screw	4 x 16 SUS304	000-802-955	4	

Installaion Materials (CP64-01800)

Name	Type	Code No.	Qty	Remarks
Blind Sheet	22-018-1015-1	100-157-961	2	
Sensor Unit Lid Opener	22-018-1017-2	100-158-032	2	
Wood Screw	5.1 x 20 C2700W	000-861-755	2	
Flat Washer	M5 C2600P	000-864-108	2	
Power Cable Assy.	MJ-A2SPF0015-030	000-133-688	2	3 m, with connector
Signal Cable Assy.	MJ-A2SPF0012-100	000-133-817	1	10 m, with connector at both ends
EMI Core	ESD-SR-15	000-134-410	2	

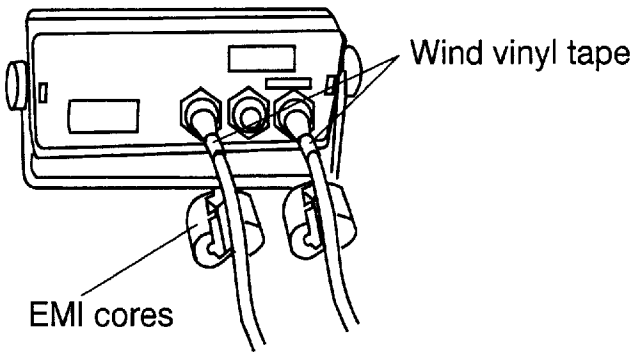
Optional Equipment

Name	Type	Code No.	Remarks
Remote Display	DD-2000-E	000-040-451	
Voltage Transformer	C-2001	000-040-412	For heading sensor
Sensor Bulkhead Mounting Kit	OP64-9	000-040-413	For heading sensor
Display Flush Mounting Kit	OP64-10	004-413-880	For display unit
Cable Assy.	MJ-A6SPF0007-100	000-125-237	10 m
	MJ-A6SPF0012-100	000-133-817	10 m
EMI Core	OP64-11	004-414-020	

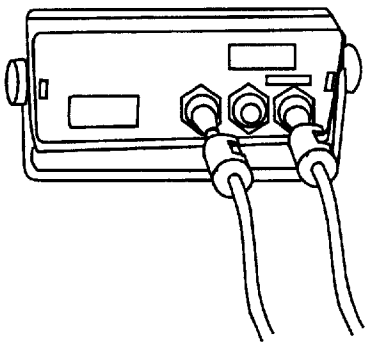
7. APPENDIX
MODIFICATION TO COMPLY WITH EMC DIRECTIVE

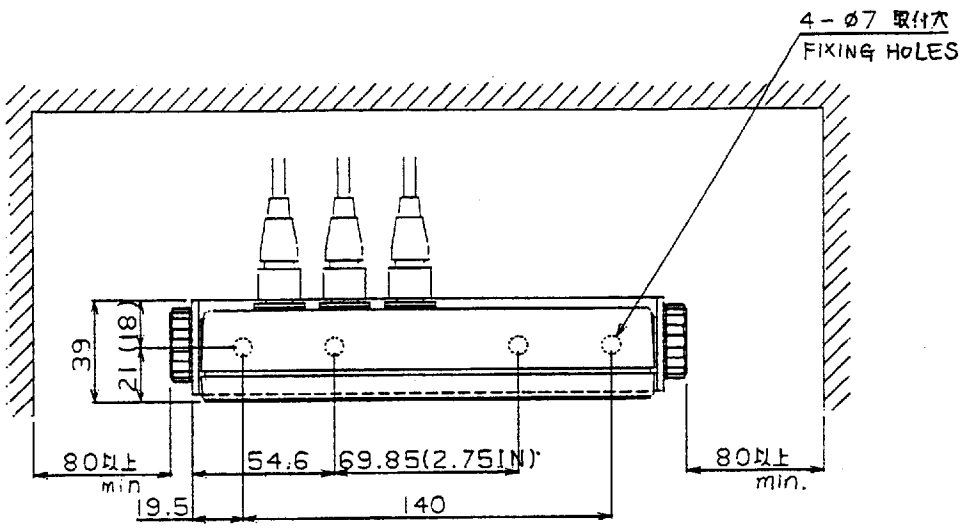
To comply with EMC directive, attach EMI core to power and signal cables as shown below.

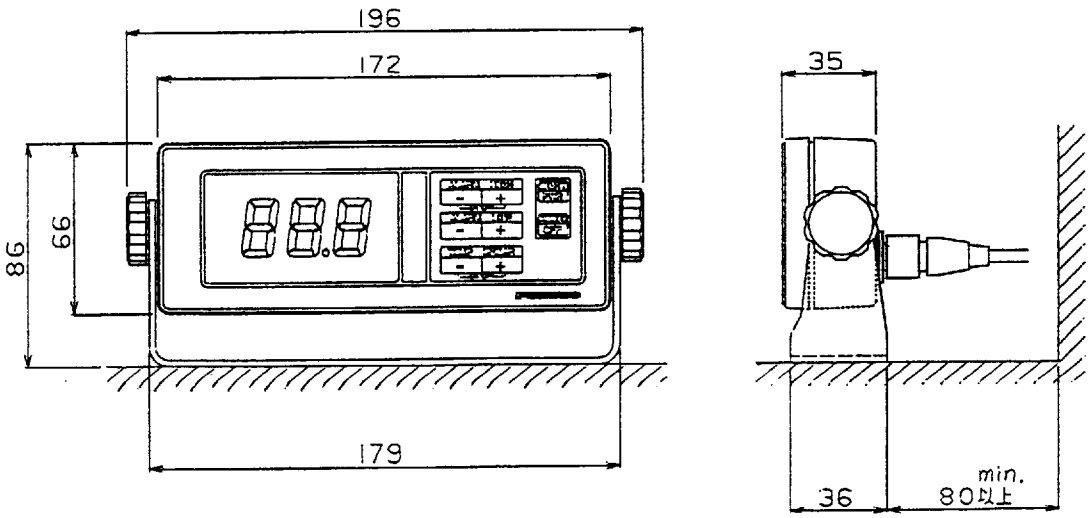
1. Wind vinyl tape close to the connectors on the power cable and signal cable. This is to prevent EMI cores from slipping.



2. Attach EMI cores where vinyl tape lies.



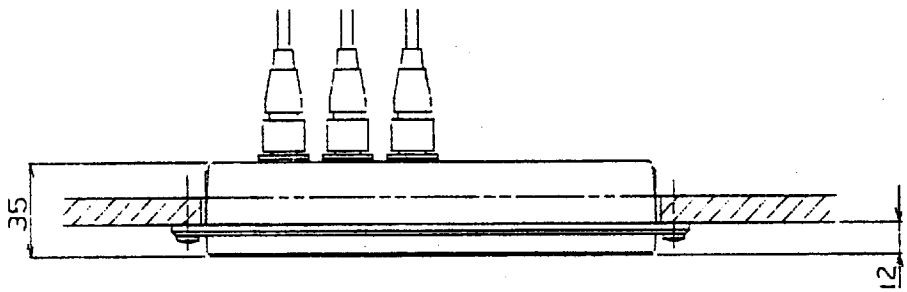


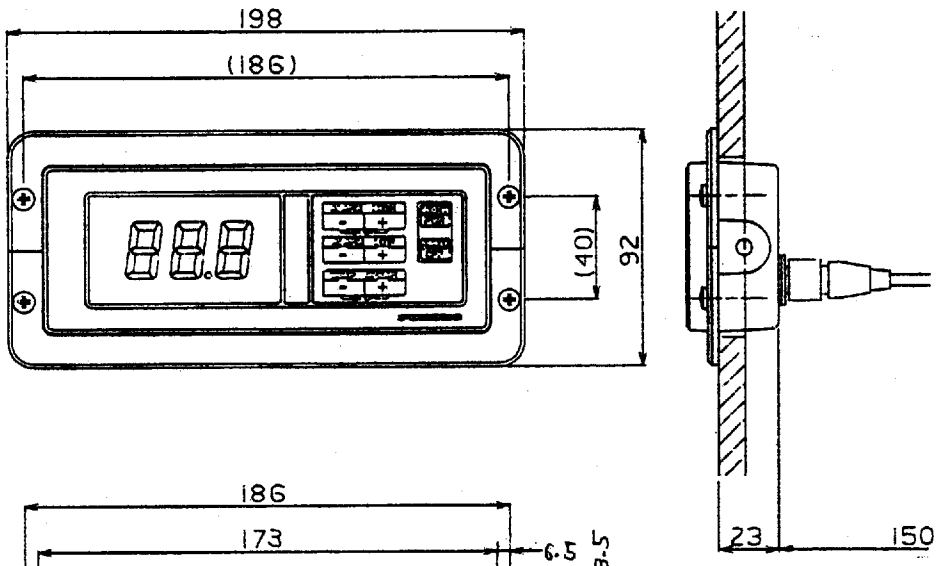


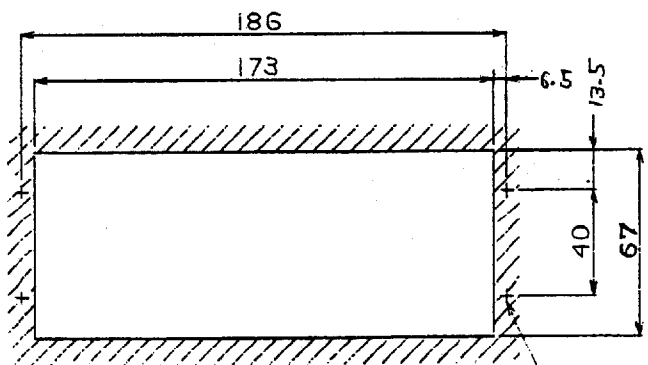
DC-2000 卓上型
TABLETOP MOUNT

承認 APPROVED	MAR 24 '94 IKEDA	三角法 THIRD ANGLE		名称 TITLE	表示部 DD-2000 DISPLAY UNIT
検図 CHECKED	MAR 14 '94 TAKAHASHI	尺度 SCALE	1/2.5		
製図 DRAWN	MAR 14 '94 MIYOSHI	質量 MASS	0.35 kg	図番 DWG.NO	C7238-G01-A

FURUNO ELECTRIC CO., LTD.







パネル取付工事穴
CUTTING DIMENSION

フラッシュマウント取付穴位置
FIXING HOLES

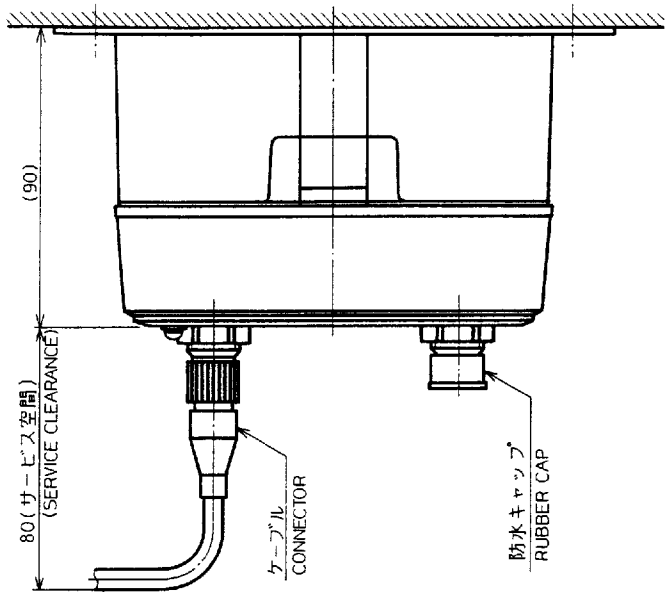
DC-2000 埋込型
FLUSH MOUNT

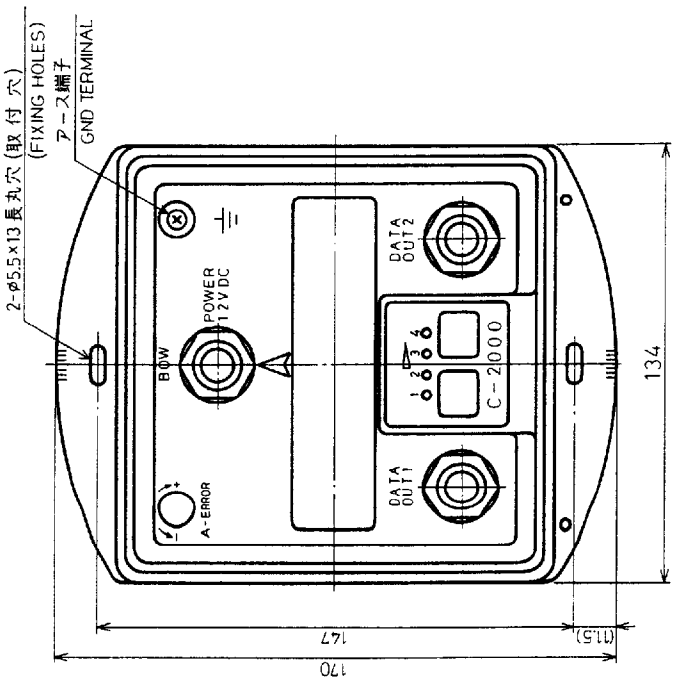
承認 APPROVED	MAR 24 '94 IKEDA	三角法 THIRD ANGLE		名称 TITLE	表示部 DD-2000 DISPLAY UNIT
検図 CHECKED	MAR 14 '94 TAKAHASHI	尺度 SCALE	1/2.5		
製図 DRAWN	MAR 14 '94 MIYOSHI	質量 MASS	0.33 kg	図番 DWG.NO	C7238-G02-B

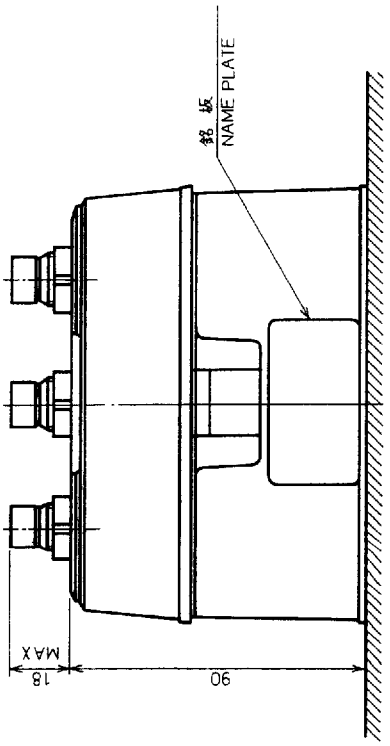
FURUNO ELECTRIC CO., LTD.

FURUNO

D - 3





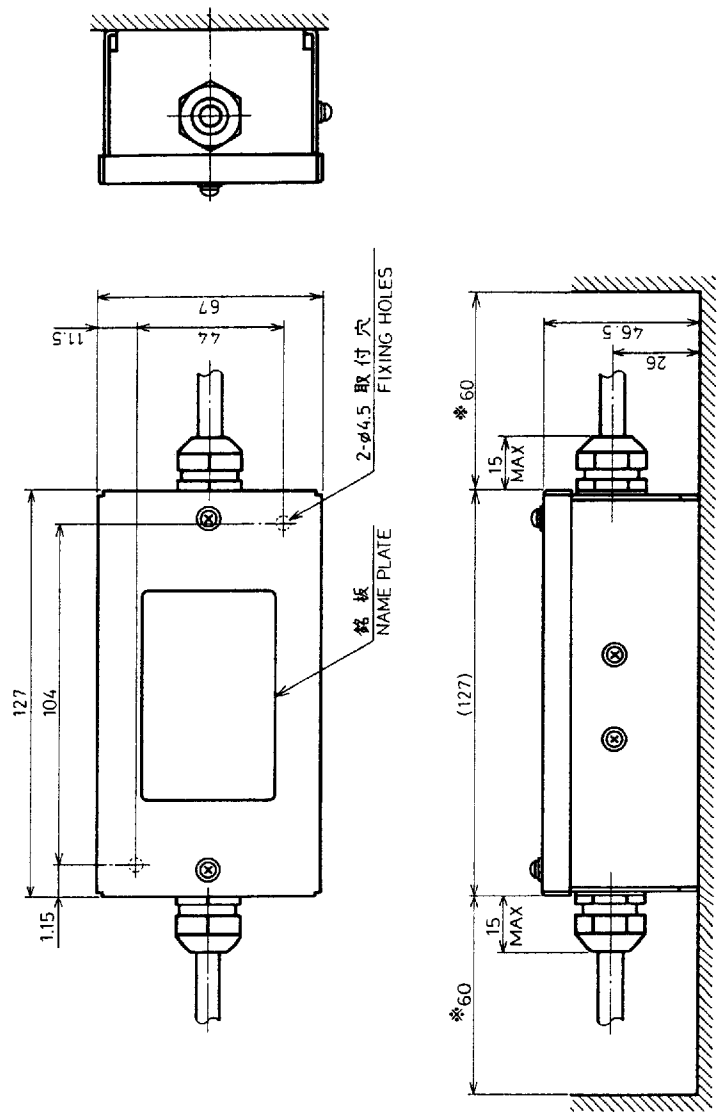


品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS

承認 APPROVED	MAR・6・'92 T. NAKANO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	ヘディングセンサ
検図 CHECKED	MAR・6・'92 T. NAKANO	尺度 SCALE	1/2	C-2000	HEADING SENSOR
製図 DRAWN	MAR・6・'92 S. NISHI	重量 WEIGHT	0.5 kg	図番 DWG.NO.	C7233-G01-A

FURUNO ELECTRIC CO., LTD.

※：推奨サービス空間
RECOMMENDED SERVICE SPACE



C-2000	品番 ITEM	品名 NAME		材質 MATERIAL	数量 Q'TY	図番 DWG.NO.	摘要 REMARKS
承認 APPROVED	MAR. 6 '92 TNAKAOO	三角法 THIRD ANGLE PROJECTION		名称 TITLE	変圧ボックス		
検図 CHECKED	MAR. 6 '92 TNAKAOO	尺度 SCALE	1/2	C-2001	VOLTAGE TRANSFORMER		
製図 DRAWN	Mar. 6 '92 S. Nishi	重量 WEIGHT	0.3 kg	図番 DWG.NO.	C7233-G02-A		

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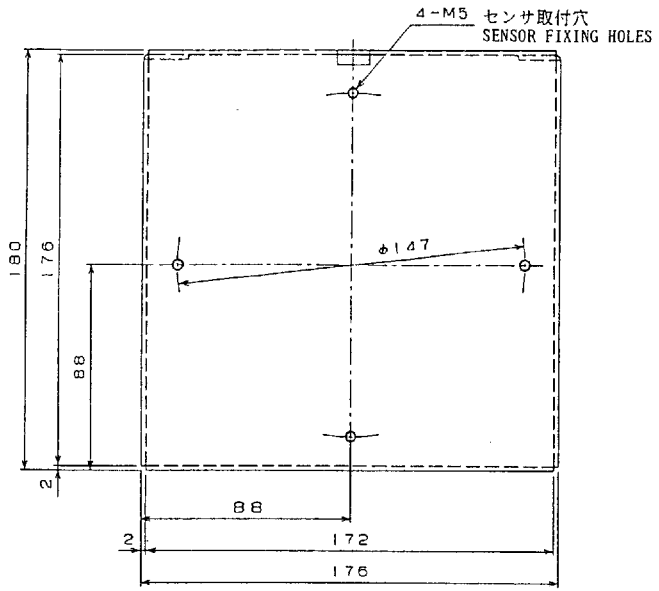
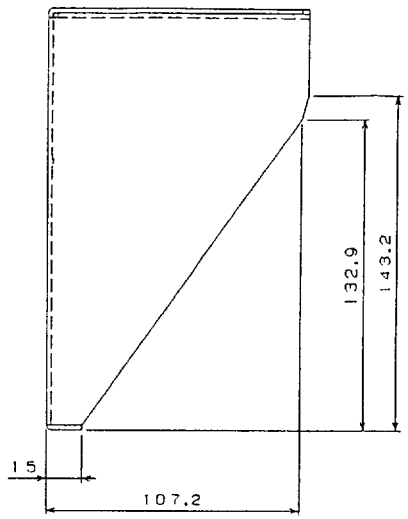
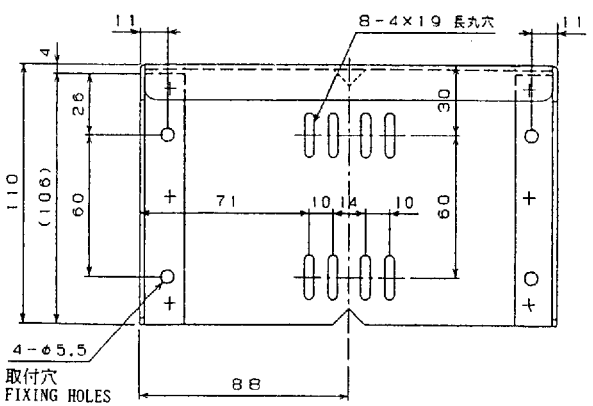
FURUNO



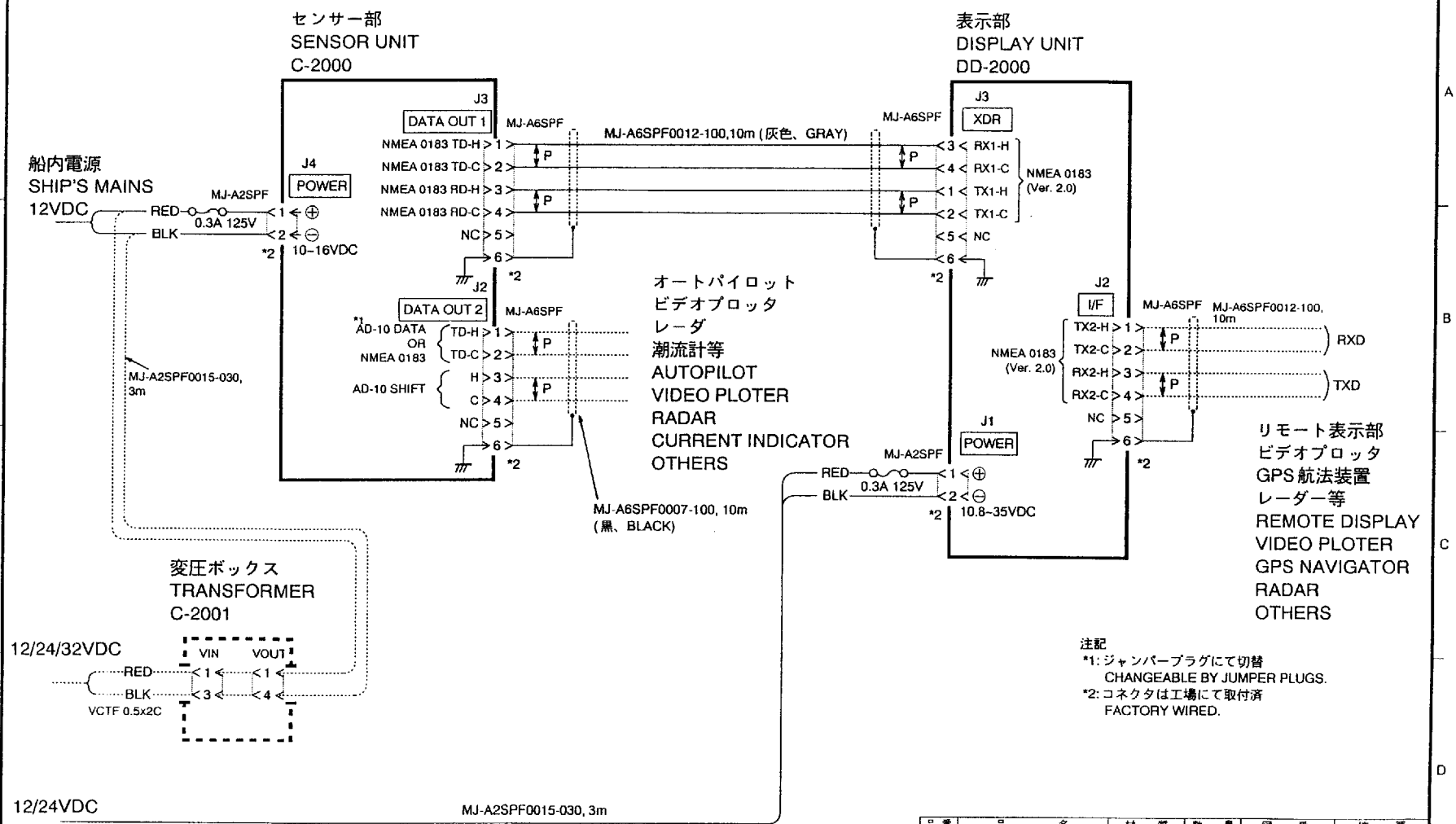




DC-2000
C-2000

承認 APPROVED	Feb·22·'94 IKEDA	三角法 THIRD ANGLE		名称 TITLE	センサ壁掛け金具
検図 CHECKED	FEB·22·'94 TAKAHASHI	尺度 SCALE	←	OP64-9	BULKHEAD MOUNTING BASE
製図 DRAWN	FEB·22·'94 MIYOSHI	重量 WEIGHT	kg	図番 DWG.NO	C7233-G03-A

FURUNO



品番 ITEM	品名 NAME	材質 MATERIAL	数量 Q'TY	図番 DWG. NO.	備要 REMARKS

承認 APPROVED	MAR・24・'94 IKEDA	三角法 THIRD ANGLE		名称 TITLE	デジタルコンパス 相互結線図 DIGITAL COMPASS
検図 CHECKED	MAR・16・'94 TAKAHASHI	尺度 SCALE	/	DC-2000	
製図 DRAWN	MAR・16・'94 MIYOSHI	質量 MASS	kg	図番 DWG.NO	C7238 − C01 − B

S-1